Running Head: UNWARRANTED PRACTICE VARIATION

Army-Baylor University Graduate Program in Health and Business Administration

Graduate Management Project

A Proposed Conceptual Model to Measure Unwarranted Practice Variation

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U.S. Army Medical Command

3 May 2007

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
27-06-2007	FINAL REPORT	JULY 2006 to JULY 2007

4. TITLE AND SUBTITLE

A Proposed Conceptual Model to Measure Unwarranted Practice Variation

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Andrew M. Barr, LTC, MC

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Medical Command
Quality Management Division
Fort Sam Houston, TX 78234

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Medical Department Center and School
BLDG 2841, MCCS-HFB (Army-Baylor Program in Health & Business Admin)
3151 Scott Road, Suite 1411
Fort Sam Houston, TX 78234-6135

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

31-07

12. DISTRIBUTION/AVAILABILITY STATEMENT

Distribution Statement A Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

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15. SUBJECT TERMS

Unwarranted Practice Variation, Theoretical Modeling, Healthcare Quality

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Education Technician
U	U	U	UL	57	19b. TELEPHONE NUMBER *(Include area code)* (210) 221-6443

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Disclosure Statement

The opinions expressed herein are those of the author and do not reflect the official policies of the U.S. Army Medical Command, Department of the Army, Department of Defense, Baylor University, or the U.S. government.

Statement of Ethical Conduct in Research

The author declares no conflict of interest or financial incentives in any product or service mentioned in this article. The confidentiality of individuals whose data may have been used in this study was protected at all times and under no circumstances will be discussed or released to outside agencies.

Acknowledgements

I wish first to thank God for the many blessings He has provided my family and me; through Him all good things come and with Him nothing is impossible. I owe a debt of gratitude to the soldiers, NCOs, and officers of the U.S. Army who have contributed to my development as an officer and physician; I am in awe of their selfless service to this great nation and strive to be worthy of their respect. I respectfully thank the faculty of the Army-Baylor Graduate Program in Health and Business Administration for their instruction and mentorship over the past two years; Ms. Cindy Perry and the staff of the U.S. Army Medical Command for their insight and instruction; COL Leo Bennett, COL Doreen Lounsberry, and the staff of the U.S. Army Medical Command Quality Management Division for their support and tutelage; and COL Karl Kerchief for his sage advice and guidance as my preceptor. I offer a special thanks to LTC Nick Coppola for his patience, direction, and collaboration over the last two years. Finally, I offer the highest appreciation and gratitude to my loving family and friends, especially my wife, Anne, and my children, Madeline and Matthew; without them and their unfailing support, my life would be empty.

Abstract

Unwarranted clinical practice variation is a well documented detractor from positive clinical outcomes. A challenge exists, however, in differentiating appropriate practice variation from unwarranted practice variation. Unwarranted practice variation can be defined as illogical deviation from clinical practice norms that do not support evidence-based medicine or patient desires. Employing a unit of analysis of the U.S. Army healthcare system and utilizing research by Wennberg and the Institute of Medicine, a model describing healthcare quality in terms of unwarranted practice variation and healthcare outcomes is posited as a framework for future investigation and study. Study limitations and recommendations for further study are discussed.

Introduction

Quality in healthcare is defined as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (Institute of Medicine [IOM], 2001, p. 232). Stated more simply, healthcare quality is judged by positive health outcomes and adherence to medical standards.

Variation, in general, is defined as a "difference or deviation from the normal or recognized form, function, or structure" (Dictionary.com, 2006). The practice of medicine is both an art and a science. Physicians balance their experience and sense of a patient's case with scholarly education and medical research to determine the best course of action for their patients. This leads to variation in medical practice that is warranted when no clear clinical path is preferable. Unwarranted practice variation (UPV), however, is defined as variation in clinical practice inconsistent with current standards of medical evidence or unsupportive of patient desires (IOM, 2001). By definition, health care quality decreases as UPV increases. At present, no model exists with which one can identify and measure the presence of UPV in a healthcare system.

The purpose of this paper is to develop a theoretical model of healthcare quality based on the concept of UPV. The model will establish a basis for identifying UPV, measure its presence through metrics, and serve as a foundation for further research on the topic. The unit of analysis for this paper is the U.S. Army healthcare system represented by the Army Medical Department (AMEDD).

Study Design

Statement of the Problem

The existence of UPV in the AMEDD contributes to poor healthcare access, rising costs, and suboptimal health outcomes. No model exists with which one can reliably identify, measure, and correct UPV within the AMEDD.

Purpose

The purpose of this paper is to develop a theoretical model of healthcare quality based on the concept of UPV.

Conditions That Prompted the Study

The AMEDD's ongoing focus on healthcare quality coupled with LTC Bill Rice's 2004 Graduate Management Project, which touched on aspects of UPV and the research of Wennberg prompted this study. A full investigation into these conditions is outlined in the literature review.

Research Question

What measurable factors contribute to UPV in the MHS?

Assumptions

It is assumed that a model adequately describing and measuring UPV can be developed. Understanding that a complete model will be difficult to develop due to ongoing research, this model will serve as a starting point for further research.

Delimitation

This project will limit itself to a review of the current literature, modeling theory, and AMEDD strategy.

Limitations

The main issue arising from a problem of this complexity rests primarily in the nuances of medical practice and the very definition of variation as it applies to that practice. The key to the difference between acceptable practice variation and UPV is an accepted standard of care based on evidence. Evidence-based algorithms and best practices are ever changing and evolving; what was acceptable one month may be unwarranted the next month and vice versa (Phillips, 1998). The limited depth and breadth of currently accepted evidence-based medicine protocols is a significant limitation to this project.

Although truly a study of quality, this project is limited in scope to comment only on the evaluation of variance of medical practice in the AMEDD, a subset of the larger issue of healthcare quality.

Significance of the Study

The objective behind developing a model that adequately describes UPV is to provide healthcare administrators and providers a tool with which they can identify substandard practices in their facilities and take action to correct them. This is extremely important in light of rising healthcare costs and limited healthcare budgets. Any assignable unwarranted variation that can be identified within the AMEDD presents an opportunity for correction and potential for improved outcomes in the form of recoupment of wasted funds, improvement of healthcare quality, or increased positive clinical outcomes.

Procedures

Qualitative Research Strategy

Qualitative research focuses on the subjective yet systematic observation and documentation of life's experiences rather than the numerical quantification and statistical interpretation of these phenomena common to quantitative techniques (Coppola, 2006). Qualitative techniques focus on an evolving style of inquiry producing a holistic view of the world around us devoid of judgments and limitations. Qualitative research often establishes a strong foundation of observations that can be further explored using qualitative or quantitative techniques.

One strategy for approaching qualitative research is the case study. Creswell defines a case study as a qualitative research method where "the researcher explores in depth...a process...bounded in time and activity" and "collect(s) detailed information using a variety of data collection procedures over a sustained period of time (2003, p.15). This method lends itself well to the development of theoretical models. It allows the researcher to fully explore both the process under investigation as well as the literature pertaining to that process and provides ample time and information to support the model being proposed. After a full discussion of variation, theory, and modeling, it is the author's intention to develop a model based on precedent and current research that will identify and measure UPV in the AMEDD.

Role of the Researcher

Due to the interpretive nature of qualitative research, the researcher must be aware of and publicly recognize potential biases and conflicts of interest between himself, the research subject, and the organization under study (Creswell, 2003.) Though these concerns are lessened

somewhat by the goals of this project, there are certain issues that should be discussed. This project is at risk for two potential biases: "backyard" research and professional bias.

Creswell defines backyard research as that taking place primarily within the organization one works in. The main concerns focus around the inability of the researcher to honestly reveal findings uncovered during the research or power issues that arise from hierarchical work relationships between the researcher and his superiors. In our case, the study design itself helps mitigate some of these concerns, namely the primary data gathering will come from established literature and not rely on intraorganizational sources. Power concerns are mitigated by the support of immediate superiors for the project and their hope to move the organization forward by providing building blocks for future best practices.

Professional bias is also a concern in this endeavor. As a Family Physician with leadership experience in operational and administrative medicine, I have developed a personal gestalt of what right looks like in the field of medicine. To mitigate this bias, I must rely solely on the results of a broad investigation of the literature to guide my project and minimize my personal thoughts on the subject.

Data Collection and Recording Procedures

Creswell (2003) identifies three steps in data collection: 1) setting the boundaries for the study, 2) collecting information, and 3) establishing an information recording protocol. The boundaries of scope for the study were discussed earlier and are limited to a review of current literature pertaining to UPV, examination of current trends in the AMEDD, and production of a model to identify and measure UPV.

Information will be primarily collected through review of literature in scholarly journals and AMEDD publications. Collecting information through document review yields many

strengths and weaknesses (Creswell, 2003). Among the strengths, information collection from documents is convenient for the researcher, includes data that is well constructed and organized, and saves the researcher time in compilation. Among the weaknesses, information collection from documents may be protected by copyright law making it inaccessible to the researcher, requires the researcher to discover information that may be difficult to locate forcing him to investigate with extreme diligence, and may yield data that is incomplete, inaccurate, or unauthentic.

Data recording procedures for documents is straight forward and relies on the researcher's skill at note taking and ability to glean the information important to the study (Creswell, 2003). Care will be taken to identify primary and secondary sources of data.

Data Analysis and Interpretation

Data analysis and interpretation involves preparing data for analysis, performing analyses that delve into the meaning of the data in an attempt to fully understand it, and representing and interpreting the data (Creswell, 2003). Creswell (2003, p.191-195) identifies six steps by which the researcher can successfully execute the tasks of data analysis and interpretation. This study will follow those steps as listed below.

1. Organize and prepare the data for analysis. This will be accomplished through a thorough review of the available literature including note taking and prioritization of findings.
2. Read through all the data. All findings from the literature will be reviewed to identify trends. Care will be taken to separate data with suspect value or questionable bias.
3. Begin a detailed analysis with a coding process. Once the variables for the model have been identified from the literature, prioritized findings will be reviewed and sorted by supporting criteria. Following Bacharach's approach to theoretical modeling, data

regarding endogenous and exogenous variables will be gathered. Special care will be taken to sequester data into similar groups that support the variables of the model.

4. Use the coding process to generate descriptions, categories, or themes. Coding of data will assist the researcher in discovering the themes of the actual variables of the model. We expect the data to focus on specific aspects of UPV and methods to measure it.
5. Advance how the descriptions will be represented in the qualitative narrative. The qualitative narrative will take the form of a theoretical model. The model will be further explained in narrative form for each construct, variable, and measure and will include examples of hypotheses to test the model.
6. Make interpretations of the data. Interpretations of the model will be explained in the Recommendations section and will feature lessons learned and potential opportunities for the AMEDD to decrease UPV throughout the force.

Validating the Findings

Cooper and Schindler (2003, p. 231) describe validity as "the extent to which a test measures what we actually wish to measure" and reliability as a measure of "accuracy and precision." Unlike quantitative research, where validity and reliability are used to define the veracity and reproducibility of data itself, qualitative research focuses primarily on validity as accuracy from the viewpoint of the researcher (Creswell, 2003). Creswell (2003, p.196-197) suggests a number of strategies through which qualitative validity can be achieved; those listed below will be utilized in this project.

1. Triangulate different data sources of information by examining evidence from the sources and using it to build a coherent justification for themes. This method of validation is perhaps the easiest and most important strategy for a project that relies heavily on

literature review as a basis for theoretical model building. Multiple sources proffering similar themes will be sought as justification for the components of the model.

2. Use rich, thick description to convey the findings. The narrative elements of the project will use multiple, real-world examples and current literature on the subject to support the model.
3. Clarify the bias the researcher brings to the study. Where applicable the researcher will elucidate any perceived bias as it applies to the literature chosen, model produced, or recommendations made.
4. Present negative or discrepant information that runs counter to the themes. Where it is discovered, alternative viewpoints will be presented that challenge the model.

Expected Findings

It is expected that a model that identifies and measures UPV will be created. It is also expected that this model 1) will be of academic and practical value, 2) will stimulate further thought and research on the topic, and 3) will help focus future quality efforts within the AMEDD.

Literature Review

A History of Quality

Quality is defined as a "character with respect to fineness, or grade of excellence" (Dictionary.com, 2006a). Applied to capitalist economic systems, quality may be thought of as that which makes a particular good or service superior to that of a competitor.

Quality was recognized by early tradesmen as something of value to their customers. Beginning in the latter 13th century, European craftsmen organized themselves into trade unions

known as guilds (American Society for Quality [ASQ], 2006). Early trade guilds set strict rules regarding membership, practices, and the quality of goods and services. Guilds established the practice of marking flawless goods with special symbols attesting to their quality. The 19th century heralded the factory production methods of the Industrial Revolution; quality control during this era centered on teams of managers and inspectors focused on evaluation of finished products.

It was not until the early 20th century that the manufacturing process was considered a part of the quality equation (ASQ, 2006). Walter Shewart and his concept of Statistical Quality Control created a focus in manufacturing on preventing poor quality from occurring rather than correcting it after it happened. In the 1950s, W. Edwards Deming's 14 points on quality and managerial processes led to a business culture now known as Total Quality Management (Austenfeld, 2001). Deming's influence over Japanese industry led to Japan's prominence as a producer of high quality goods in the latter half of the 20th century and spurred the global focus on quality in industry.

In 1987, the U.S. Congress created the Baldrige National Quality Program to promote and recognize corporate quality excellence in American industry. That same year, the ISO 9000 series of quality-management standards were published by the International Organization for Standardization to improve quality through regulation of international product standards (ASQ, 2006).

Quality continues to be a significant focus in the world of economics as evidenced by the recent prominence of programs such as Lean Six Sigma, which strives to minimize defects while promoting efficient processes. Quality touches all segments of the economic world from private industry to government, service to manufacturing, even education and healthcare (ASQ, 2006).

Quality in Healthcare

Avedis Donabedian, in his treatise "Evaluating the Quality of Healthcare," attempted to codify the concepts of quality in the field of healthcare. His work provided us with the "Structure-Process-Outcome" model of healthcare quality that has stood the test of time for over 40 years. Early in his thesis, Donabedian admits that quality, as it applies to healthcare, is not a unitary concept and may never be defined by a single comprehensive criterion (Donabedian, 1966). An operational definition for healthcare quality is elusive at best and takes shape from the criteria, expectations, and biases of the individual defining the term. Perhaps Donabedian's most influential contribution to the study of healthcare quality was to define quality in terms of relevant outcomes, which tend to be valid, stabile, and concrete, and the structures and processes inherent in the practice of medicine that lead to healthcare outcomes, which are identifiable, measurable, and malleable.

Recognizing that quality is only one aspect of the healthcare industry, Kissick (1994) developed a concept known as the Iron Triangle of Healthcare. In this triangle, quality forms one angle of the structure with cost containment and access comprising the other two. These three factors are kept in balance by the expectations, cultural goals, and economics of the society which support the industry. Any angle (factor) in the triangle can be increased, but only at the expense of the other two. For example, quality in the American healthcare industry can be improved but only by adversely affecting some combination of access and cost containment.

The 1990s witnessed the rise of the managed care organization (MCO) in the American health care industry due primarily to rising healthcare costs and corporate concerns over profitability (Shi & Singh, 2004). MCO's early focus on cost containment and access limitations as methods to increase profits eventually became balanced with popular concerns of their effects

on healthcare quality. As the rise of managed care organizations spread across the United States, so too did a burgeoning focus on the quality of the health care provided within the walls of the healthcare industry.

Quality in the Army Medical Department

The U.S. Army formally incorporated the concept of quality into its lexicon in 1992 with the introduction of the Total Army Quality (TAQ) program (Department of the Army Center for Military History, 2006). TAQ was heavily based on Deming's principles of TQM and focused on continual quality improvement (CQI) in an effort to satisfy the needs of all Army customers. Army training programs were initiated focusing on TQM and CQI throughout the remainder of the 1990s in an attempt to move the Army's corporate culture towards higher quality.

The AMEDD has focused on various quality programs over the past 15 years including TQM and CQI. During LTG James Peake's tenure as Surgeon General of the Army in the early 2000s, the AMEDD instituted a balanced scorecard process to focus its corporate business processes (Holt, 2001). The AMEDD balanced scorecard placed emphasis on the financial, customer, internal process, learning and growth, and strategic planning perspectives of the AMEDD's operations. Part of this initiative focused on the works of Wennberg and medical practice variation as a contributor to cost and quality measures (Rice, 2004). During this same period, the AMEDD focused on the development of clinical practice guidelines (CPG) founded on evidence-based medicine (Nichols, Farley, Vaiana, & Cretin, 2001).

The Army's CPG program was created through a joint venture between the Department of Defense (DoD) and the Department of Veterans Affairs (VA) in 1998 (Farley et al., 2004). The purpose behind the CPG initiative was to establish a single standard of care between the DoD and VA health systems for certain medical conditions in an effort to decrease UPV and

increase health care quality. DoD/VA CPG, currently numbering 23 (Department of Veterans Affairs, 2007), are developed by a panel of experts and are based on current clinical evidence and best practices. CPG are composed of algorithm-based treatment plans, their supporting evidence, and metrics to track compliance and outcomes. Clinical decisions based on CPG offer patients the highest quality care supported by the medical literature. CPG also promise to decrease unwarranted variation in practice where clear medical evidence supports a particular pattern of practice though evidence supporting this aim is scant at present.

Currently, the AMEDD is focusing on initiatives such as Lean Six Sigma, Performance Based Adjustment Model (PBAM) budgeting (Kiley, 2007), and Healthplan Employer Data and Information Set quality measures (U.S. Army MEDCOM Quality Management Office [QMO], 2007). Minimization of UPV is a component in each of these initiatives as well as others utilized by the AMEDD.

Crossing the Quality Chasm

In 2001, the Institute of Medicine published its treatise on the state of U.S. healthcare quality, *Crossing the Quality Chasm*. The second document of a two part series published by the Committee on the Quality of Healthcare in America, *Crossing the Quality Chasm* followed 1999's *To Err Is Human*, which outlined the state of healthcare safety in America. *Crossing the Quality Chasm* focused on the gamut of healthcare quality and presented ideas on how the American healthcare system could be redesigned to support strategic innovation in an effort to improve overall healthcare quality (IOM, 2001).

Central to the recommendations outlined in *Crossing the Quality Chasm* were six goals of healthcare system improvement to guide the way ahead. The IOM (2001) recommends that all healthcare systems focus on providing care that is: (a) safe (avoiding injury to patients); (b)

effective (based on scientific knowledge and provided to those who may benefit [preventing underuse] while withheld from those who won't benefit [preventing overuse]); (c) patient-centered (focused on, respectful of, and guided by patient values); (d) timely (reducing harmful or unnecessary delay in treatment); (e) efficient (avoiding misuse of logistic and mental capital); and (f) equitable (equal quality of care across socioeconomic strata). The aims of *Crossing the Quality Chasm* have set a high standard for the optimized healthcare system. Variation of healthcare from the micro to macro levels negatively impacts each aim set forth by the IOM.

Recent Quality Initiatives

Besides evidence-based practice and clinical practice guidelines, a number of healthcare quality initiatives have appeared over the past 20 years. Though preexisting the publishing of the IOM's six aims, many of the following initiatives support one or more of the tenets established by *Crossing the Quality Chasm.*

Patient Safety

Perhaps the most well-known organization advocating for patient safety is the Joint Commission. Established in 1951, the Joint Commission began as an independent organization dedicated to the accreditation of hospitals based on standards established by the American College of Surgeons (The Joint Commission, 2007). Core to the Joint Commission's modern-day accreditation standards is the principle of patient safety. Among their key patient safety initiatives, the Joint Commission developed a "Do Not Use" list for easily confused and dangerous medical abbreviations; authored infection control standards; established a Universal Protocol for preventing surgical error involving the wrong site, procedure, or patient; and annually publishes a list of National Patient Safety Goals.

In 1999, the IOM estimated that up to 98,000 lives are lost each year in hospitals across the nation due to preventable medical error (IOM, 1999). HealthGrades, a healthcare ratings organization, estimates that the true number is closer to 195,000 lives annually (HealthGrades, 2004). In January of 2005, the Institute for Healthcare Improvement (IHI) introduced a quality improvement scheme called the 100,000 Lives Campaign. The campaign aimed to reduce preventable death by 100,000 patients in hospitals across the country through a combination of infection prevention and proactive patient care. At the program's conclusion, it was estimated by the IHI that its 3,100 participating hospitals had prevented 122,000 deaths (Institute for Healthcare Improvement, 2007). The IHI has since expanded the campaign to 5 million lives. The AMEDD actively supports the patient safety initiatives created by the Joint Commission and the IHI among others (QMO, 2007).

HEDIS and Disease Management

In the early 1990's, the National Committee for Quality Assurance (NCQA) developed a program to gather performance data from the nation's health plan providers as a method to benchmark the quality of care they provided (National Committee for Quality Assurance, 2007). The Health Employer Data and Information System (HEDIS) currently gathers data from 90% of the nation's health plans utilizing 71 measures in 8 healthcare categories ranging from effectiveness and cost of care to patient satisfaction.

As part of its internal quality improvement plan and its Performance Based Adjustment Model (PBAM) budget program, the AMEDD currently tracks the performance of its MTF's compared to the HEDIS 50^{th} and 90^{th} percentile benchmarks of seven healthcare measures (QMO, 2007). Under these programs, AMEDD MTF's are judged by the percent of their eligible beneficiary population with: a) mammograms, b) long-term asthma controller medications, c)

HbA1C testing for diabetics, d) HbA1C test results less than 9.0, e) LDL test results less than 100 for diabetics, f) cervical screening, and g) colorectal exam (AMEDD Command Management System, (2007).

One of the benefits of HEDIS measures is their ability to focus a healthcare system on the needs of high-risk, high-cost, high-volume patient groups such as asthmatics and diabetics. Disease management takes this focus one step further by creating multi-disciplinary teams to track and manage the healthcare of these groups in a holistic manner. One study showed improvements in the care of asthmatics through disease management resulting in a 47% decrease in emergency department utilization and a 71% decrease in admissions (Kibbe, 1998). Innovative treatment programs such as group appointments allow case management to add measures of efficiency to improved patient care (Houck, Kilo, & Scott, 2003).

Open Access

Often part of a healthcare optimization plan, open access scheduling satisfies many of the aims set forth by the IOM. The quintessential patient-focused quality improvement program, open access is built around clinic efficiency, improved access, and continuity of care. Developed by Dr. Mark Murray in the early 1990's, open access' mantra of "do today's work today" resonates with both physicians and patients alike (Murray & Tantau, 2000). Efficient processes such as standardized exam rooms and empowerment of ancillary staff fuel the open access process. The key to success with open access, however, is changing the paradigm of how care is provided. The traditional model of multiple appointment types, clinics fully booked weeks in advance, and patients seen in a provider-by-committee manner is transformed to a model with a minimal number of appointment types, clinics 65-75% open at the start of the day, and patients

being seen by their provider. Providers gain ownership of their patient panel and patients gain trust in their healthcare system.

The literature is full of references pointing to the success of open access programs (Murray & Tantau, 2000; O'Hare & Corlett, 2004). In 2001, the AMEDD initiated an open access program at select clinics in the European Regional Medical Command that laid the groundwork for future efforts throughout the Army's healthcare system. Open access has met with varying levels of success in the AMEDD and faces unique challenges due to the manpower and continuity constraints inherent to the Army (Whitney, 2005; Hankins, 2004).

Transparency and Information Technology

In this age of burgeoning patient-centricity, a movement is afoot pushing for greater transparency of costs, quality, and information throughout our healthcare systems. Information technology (IT) supporting electronic health records (EHR), patient accessible medical records, and administrative data collection and planning tools is central to this concept and must be supported and guided by healthcare organizations and the federal government (The Lewin Group, 2005).

In April of 2004, President Bush called for EHR for most Americans within ten years (U.S. Department of Health and Human Services, 2004). EHR have been under development by multiple companies in the U.S. and abroad for years, but their capabilities vary significantly by software application (The Lewin Group, 2005). Both private and public organizations are currently discussing methods to standardize EHR for the American healthcare market.

The Department of Veterans Affairs and the Department of Defense have developed two of the more robust entries in the world of EHR, VistA and AHLTA, respectively. VistA has long been recognized as a state-of-the-art EHR receiving praise from such organizations as RAND

and winning the Innovations in Government Award in 2006 (U.S. Department of Veterans Affairs, 2006). With more functionality and granularity than VistA, AHLTA serves DoD recording over 300,000 outpatient visits per week (U.S. Medicine, 2005) though concerns abound over its stability and speed (Philpott, 2006). Regardless of concerns about interoperability and setting of care, the federal government's efforts at EHR have set the standard for health information technology. Future collaboration between the VA and DoD looks to both further the capability of the technology and improve healthcare quality through legibility, data capture, and sentinel event warnings (Kussman, 2006).

One area where EHR lend themselves to other patient-centric initiatives is patient accessible medical records. According to one study, 75-95% of inpatients would like access to their medical records while admitted to a healthcare facility (Ross & Lin, 2003). The main reasons for this desire according to patients are involvement in their healthcare decisions, education about their medical conditions, and sheer curiosity. Medical professionals have long been reticent to allowing patients access to their records fearing litigious or ulterior motives. Studies show these apprehensions to be unfounded citing benefits that outweigh risks.

Perhaps the greatest potential for IT is in the arena of administrative data collection and decision making tools. As quality healthcare continues to be judged more by evidence and outcomes, it will become imperative for organizations to produce more reports, track more metrics, and make more strategic decisions regarding the direction of an organization and the services it offers (U.S. Department of Health and Human Services, 2007). From budgetary, manpower, and temporal perspectives, IT must be relied upon to perform these functions.

Variation and UPV

Variation in medical practice is due in large part to differences in medical training, geographic region, and local preferences; the vastness of medical knowledge; the complexity of human disease and behavior; and errors in judgment (James & Hammond, 2000). In a world of medical uncertainty, practice variation can be seen simply as a measure of a physician's judgment and training applied in the best interests of his patient and should be expected (Phillips, 1998). Compounding this concept of variation is the fact that little evidence actually exists that reliably predicts what combination of protocols and visit frequencies, on the whole, actually improves healthcare outcomes (Wennberg, 2002); in essence, few standards exist by which systemic variation can be reliably judged. Understanding these facts, what differentiates acceptable variation from unwarranted variation?

The IOM (2001) states that clinical practice should not vary illogically from physician to physician or place to place. Though the physician's autonomy in clinical decision making remains paramount in today's healthcare environment, it does not necessarily reflect the current evidence base and often leads to variation that negatively impacts healthcare outcomes. Echoing the patient-centric guidance of the IOM, Wennberg and Wennberg (2003) state that healthcare should be consistent with patient preferences and relate to the patient's underlying illness; care that does not meet these criteria should be considered unwarranted practice variation. Thus, UPV can be defined as healthcare that illogically deviates from evidence-based practice in clinical, systemic, or geographic areas and fails to support the wishes of patients.

Unwarranted practice variation (UPV) is a recognized contributor to poor healthcare outcomes yielding both increased healthcare costs and decreased positive clinical results (Rice, 2004). It is estimated that 57,000 lives are lost each year due to a lack of implementation of

evidence-based medicine protocols (Sipkoff, 2003). Ceteris paribus, surgical rates in certain parts of the U.S. reach a level five-fold that of other regions of the country based on geography alone yielding unnecessary medical procedures and increased costs (The Dartmouth Atlas of Healthcare [Dartmouth], 2006). If the surgical rates of the lowest region were applied to the entire country, Medicare would have saved $46 billion in 1996. Additional areas where similar geographic unwarranted variation exists include pharmacy, laboratory, and radiology.

Wennberg

Wennberg (2002) classifies healthcare into three categories: effective care, preference-sensitive care, and supply-sensitive care. This section addresses these three areas.

Effective Care

Effective care is defined as care that is based on clinical evidence or research. Also known as evidence-based medicine (EBM), it encompasses medical care that is proven to work well; all patients should receive care based on EBM when applicable. Examples of effective care include medical regimens following heart attacks, diabetes and asthma treatment protocols, cancer screening programs, immunizations, and clinical practice guidelines (CPGs). Studies show extensive underuse of effective care in the U.S. healthcare system due mainly to a lack of infrastructure. Correction of this form of UPV requires universal improvement in the ability of our health system's infrastructure to ensure that appropriate care is provided in a timely fashion. Staff model HMOs provide excellent examples of how this transition can occur through their development and utilization of disease management protocols, promotion of provider compliance with CPGs, and collection and usage of health insurance claim data to identify patients who require particular services (Wennberg, 2002). The point of leverage for improvement of effective care UPV resides at the hospital and physician group levels (Wennberg & Wennberg, 2003).

Preference-Sensitive Care

Preference-sensitive care (PSC) is defined as care where at least two valid treatment strategies exist, each with its own risks and benefits, and neither option has a clear outcome benefit over the other. As PSC involves risk-benefit tradeoffs, the patient's risk tolerance and personal preference should drive decision making. Examples of PSC treatment decisions include surgical vs. medical treatment options, choices regarding diagnostic or treatment options for chronic medical problems, and choice between equivalent pharmaceuticals. Studies show widespread misuse of PSC by the healthcare industry most likely due to clinical uncertainty on the part of physicians; this is often due to a lack of evidence regarding risks, benefits, and outcomes leading many physicians to steer patients into more liberal and, hence, more invasive, treatment options. Provider opinion and experience tends to dominate the patient's ability to make an informed decision leading to UPV, unnecessary treatment, and increased costs. The fundamental problem with PSC, however, resides in a failure to involve the patient in a meaningful way in the choice of treatment; though unpalatable to many physicians from management and expertise aspects, yielding control of PSC treatment decisions rightfully returns autonomy to the patient. Correction of this form of UPV necessitates physicians to provide focused education regarding risks, benefits, options, and costs to patients, requires patients to become actively involved in treatment decisions where appropriate, and calls for the healthcare system to abandon rewards for unnecessary treatments and excessive interventions (Wennberg, 2002). The point of leverage for improvement of PSC UPV resides primarily at the doctor-patient interaction (Wennberg & Wennberg, 2003).

Supply-Sensitive Care

Supply-sensitive care (SSC) is defined as those healthcare services where the frequency of use has not been reliably determined by medical theory, professional consensus, or scientific evidence. Examples of SSC include physician office visits, diagnostic tests, hospitalizations, and admission of the chronically ill to intensive care units (ICU). Studies show widespread overuse of SSC with large amounts of regional variation. For example, during the last six months of life, Medicare enrollees in some regions of the U.S. average more than 20 visits to medical specialists and experience death in an ICU 30% of the time; in other regions, specialty visits average fewer than three with ICU deaths occurring less than 7% of the time. The primary reason for the regional variation in SSC is availability of local resources. Analogous to Roemer's Law ("a built bed is a filled bed" [Shi & Singh, 2004, p.287]), SSC UPV is a function of local supply of healthcare services. More hospital beds per capita yields more hospitalizations per capita; more physicians per capita yields more visits per capita. What makes SSC wasteful from both clinical and financial perspectives is the paucity of evidence showing a benefit from the care received. There is little data available regarding positive healthcare outcomes in relation to the number of physicians by specialty required in a given region, the recommended rate of chronic disease visits, or whether expensive diagnostic technology improves diagnosis, health, or survival. Despite the American cultural belief that more care is better care, population studies have shown no gain in life expectancy associated with a higher frequency of medical intervention. Regardless of these issues and a growing interest among physicians and administrators in EBM, topics of concern to SSC receive little attention from researchers. Correction of this form of UPV requires an active, systemic refocusing on capacity management, disease management, clinical "best practice" benchmarks, and utilization-focused, outcome-

based research; in light of current reimbursement formulas, a lack of significant medical evidence, and a relative inability to systemically deal with SSC UPV, the task of correcting this form of UPV is daunting at best (Wennberg, 2002). The point of leverage for improvement of SSC UPV resides primarily at the healthcare system level (Wennberg & Wennberg, 2003).

Theory

The word theory is derived from the Greek word *theorein* which means "to look at" or, more romantically, "to contemplate the divine" (Wikipedia, 2006d). In science, theory is seen as a systematic, formalized, logical framework with which we can describe a related set of phenomena. Both testable and measurable, theories can be disproved through experiment or empirical observation and can reasonably predict future occurrences or outcomes of the interactions amongst the phenomena described. Theories should be dynamic, to allow for correction as data becomes available, and parsimonious. Parsimony, in scientific terms, supports the principle of Ockham's razor, which states "of two equivalent theories or explanations, all other things being equal, the simpler one is preferred" (Wikipedia, 2006c); it is a measure of simplicity and economy which holds that assumptions or explanations which provide no tangible benefit to a theory be eliminated. Theories that have stood the test of scientific rigor, having been either confirmed or not disproved by repeated testing, become known as laws and are no longer referred to as theories.

Models

Models are tools of prime importance in the practice of modern science; through them, scientists and philosophers build, test, and modify the formulas and theories by which we understand our universe (Frigg & Hartmann, 2006). The purpose of a model is to provide an argumentative structure for the investigation of theories enabling examination and quantification

of theories in a rational and regimented manner. The logical framework or anatomy of a theory is often the basis for its model (Wikipedia, 2006d). Models often refer to limited aspects of the phenomena in question; it is not uncommon for two models, each describing the same phenomena, to significantly differ from each other (Wikipedia, 2006b).

There are myriad types of models utilized in the fields of science and philosophy. Frigg and Hartmann (2006) categorize models as either representational, describing or symbolizing a concrete feature of a real-world target system, or theoretical, explaining the abstract features of a theory. Representational models are further divided categorically by what systems they describe: phenomena or data. Models of phenomena describe scientific systems that are relatively stable and general in nature and typically take one of the following forms: scale, idealized, analogical, or phenomenological. Models of data represent interpreted and idealized systems of direct observation.

Representational Models

Scale models present "a naturalistic replica or a truthful mirror image of the target (Frigg & Hartmann, 2006, p.4)" and are typically presented as percentage increases or decreases in size from the original. Models of cars, buildings, and bridges fit this category. Although commonly referred to as "true models", scale models are often not composed of the exact materials used in the target system.

Idealized models are used when simplification of complex systems is required to more easily understand, discuss, and manipulate them (Frigg & Hartmann, 2006). Examples include frictionless planes and economic markets in equilibrium. The method underlying idealized models comes from both the Aristotelian and Galilean schools of investigation. Aristotelian idealization removes aspects of the target system perceived to be irrelevant to the present

discussion to yield a simpler, more tenable system. Galilean idealization purposely distorts aspects of the target system to yield the simpler system. Important to both schools of thought is the introduction of the scientific assumption whereby systems too complex for reasonable contemplation are made understandable; due to this, idealized models are often referred to as caricatures.

Analogical models describe systems using objects with relevant similarities (Frigg & Hartmann, 2006). Examples include computer models of the human mind and billiard ball models of the properties of gasses. The importance of this type of model is that the properties of the objects used in the model are readily and easily reproduced while mimicking the target system thus allowing for investigation and experimentation with the properties of the target system.

Phenomenological models "represent observable properties of their targets and refrain from postulating hidden mechanisms" (Frigg & Hartmann, 2006, p.6). Key to many definitions of this type of model is independence from theory altogether.

Models of data are created by taking raw data, eliminating observational errors, and offering the remaining data in a concise, processed manner (Frigg & Hartmann, 2006). Data models are extremely important to the analysis of theoretical systems as it is the smoothed nature of the model, not the rough and erratic raw data, by which we judge the predictive relevance of a theory.

Theoretical Models

A conceptual, or theoretical, model can be defined as a paradigm "that represents physical, biological, or social processes with a set of variables and a set of idealized, logical, quantitative relationships between them" (Wikipedia, 2006b). Theoretical models can be thought

of as the concrete representation of an abstract scientific or philosophical concept (Frigg & Hartmann, 2006). Cinvestav (2006) describes four important characteristics of theoretical models: assumption, structure, approximation, and analogy.

First, conceptual models make assumptions. In order to simplify the systems that they attempt to explain or to provide acceptably accurate solutions, conceptual models must make assumptions regarding the theory they describe (Cinvestav, 2006).

Second, theoretical models possess internal structure through which they explain the properties of a system (Cinvestav, 2006). Models analyze phenomena by reducing them to more basic, manageable components, evaluate the phenomena through a structured process, and measure the relationships between the variables that describe the phenomena. Structure and simplification are concepts that separate models from theories. Although the words *model* and *theory* are often used interchangeably due to their shared assumptions, it is the broad, abstract nature of theories and their relative lack of formal structure that distinguishes a theory from a model.

Third, theoretical models are considered to be useful approximations for particular purposes (Cinvestav, 2006). Inherent to this definition is the realization that multiple models may exist, which serves different purposes but describe the same theory. The value of any particular model resides in its usefulness to the purpose for which it was created and the precision and thoroughness of its representation of the theory it was designed to analyze.

Fourth, theoretical models are often based on analogies between a known system and the system under investigation (Cinvestav, 2006). The utilization of analogies with known systems allows a new model to be judged based on criteria previously established, tested, and accepted for similar systems. Analogous reasoning is not sufficient to definitively test the veracity of a

model, but serves as an initial approximation and establishes a foundation for further investigation and modification.

Much of theoretical modeling in the social sciences comes from the modeling of mathematical theory (Frigg & Hartmann, 2006). It is both their abstract yet logical nature and their ability to not only describe but quantify latent concepts through measurement of variables that allows the application of mathematical models to the social sciences. Mathematical models typically consist of a set of functions that describe the relationships between variables (Wikipedia, 2006a). Although there are numerous ways to describe mathematical models, three primary categories exist: linearity, entropy, and time. First, a model's linearity is defined by the quality of the functions that describe its phenomena. If the functions are linear in nature, the model is described as linear; if the functions do not follow linear form, the model is described as non-linear. Second, the entropy, or randomness, of a model is described by the relationship between its variables and the system's parameters. Deterministic models exist when the variables are determined by the parameters of the model; this type of model is typically stable and predictable. Probabilistic, or stochastic, models, on the other hand, exist when variables are determined by probability distributions rather than unique parameters; this type of model contains significant randomness. Third, the parameter of time is described in models as either static, which do not account for time, or dynamic, which do account for time.

Bacharach

The literature is rife with opinions written by respected authors such as Sutton and Straw, Whetten, DiMaggio, Willer and Webster, and Yuksel attempting to codify and clarify the concept of theory (Coppola, 2006). In 1989, however, Dr. Samuel Bacharach wrote what some consider the seminal article concerning theory and, through his concepts of theory,

modeling. In *Organizational Theories: Some Criteria for Evaluation,* Bacharach eloquently outlined a definition of theory, the factors that comprise theory and serve as components for modeling, and criteria to judge the veracity of theory and models thereof. Bacharach's teachings serve as the basis for the modeling exercise contained in this paper.

Bacharach defines theory as, "a statement of relations among concepts within a set of boundary assumptions and constraints" (Bacharach, 1989, p. 496); its purpose is to "parsimoniously organize and clearly communicate" the wonders of the world around us. Theories answer the questions of *how, when,* and *why*; they should be "logically consistent, testable, subject to disconfirmation, and all-encompassing" (Coppola, 2006, p. 3).

Theories are composed of constructs and variables (Bacharach, 1989). Constructs are abstract, immeasurable entities that can only be approximated; they are related to each other by broad, abstract statements known as propositions. Although constructs cannot be directly observed, they can be defined by variables. Variables are observable phenomena that can be empirically operationalized by measurements; they are related to each other by concrete statements known as hypotheses. Assumptions made by an author related to personal values, time, or space limit the application and proper testing of his theory. Figure 1 demonstrates Bacharach's anatomy of a theory.

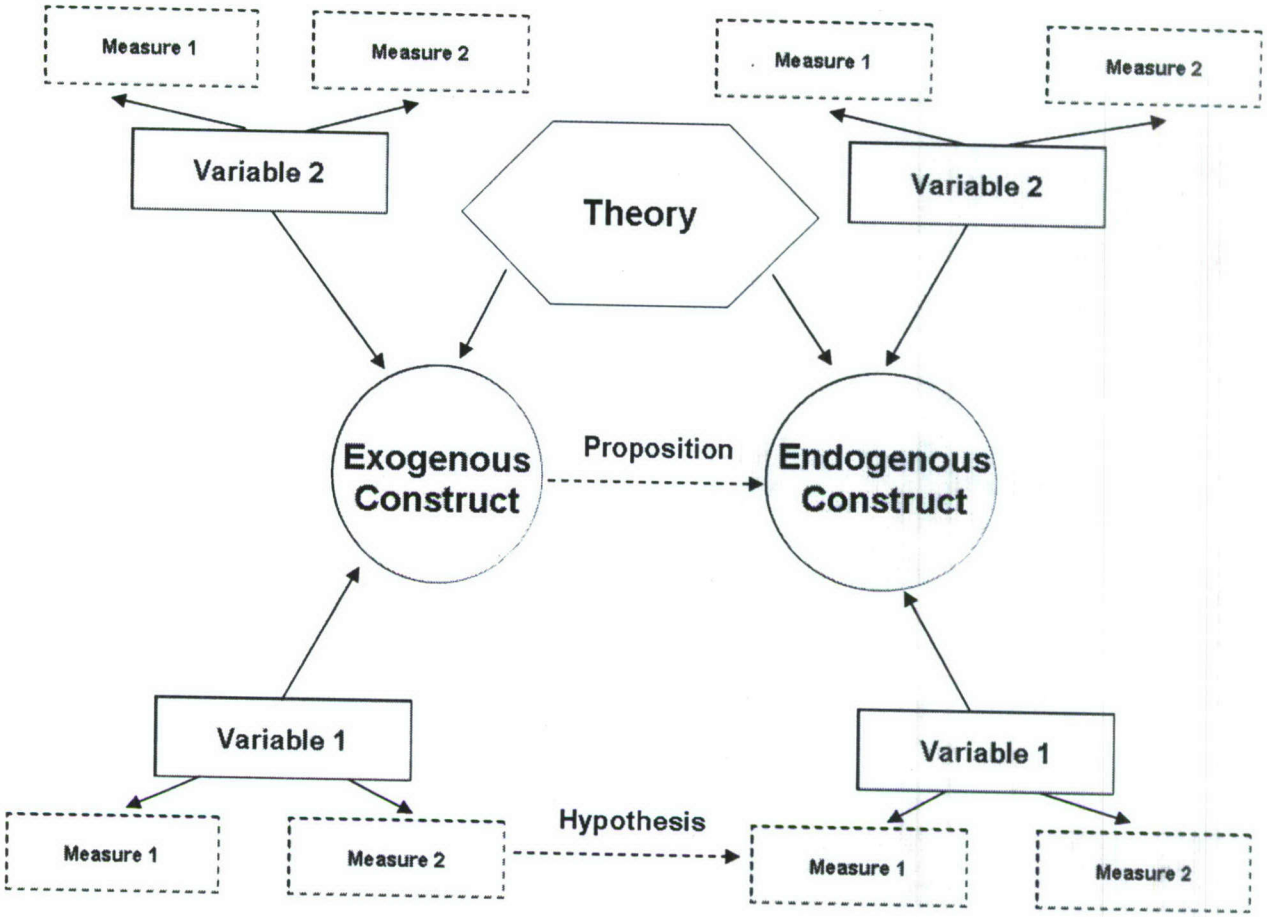

Figure 1. Conceptual model of theory based on Bacharach

For a theory to be properly evaluated, it must possess both falsifiability and utility (Bacharach, 1989). Falsifiability refers to a theory's ability to be refuted empirically, hence its capacity to be disproved. The falsifiability of variables is concerned with the adequacy of measurement; variables must be coherently operationalized ensuring validity, reliability, and noncontinuousness. The falsifiability of constructs is concerned with construct validity composed of both convergent validity and discriminant validity. Convergent validity is conferred when evidence from multiple measures and sources all point to the same conclusion. Discriminant validity holds that the construct under investigation can be differentiated from other constructs. Falsifiability also applies to the logical and empirical

sufficiency of relationships within a theory; relationships must be nontautological, logically discrete, operationalized, and subject to disconfirmation. Utility refers to a theory's usefulness. The utility of variables and constructs centers on the appropriateness of their scope measured as a balance between exploration of the domain within which they reside and parsimony. The utility of a theory's relationships is judged by their ability to reliably explain and predict based on explicit assumptions, specificity between antecedent and consequent, scope, parsimony, boundaries of space and time, and minimization of the probability of disconfirmation.

It is in this framework of theory and conceptual modeling that Wennberg's research on unwarranted practice variation and the goals of the Institute of Medicine will be evaluated in light of the concept of healthcare quality.

Conceptual Model

Model

A conceptual model for a theory of healthcare quality is found in Figure 2.

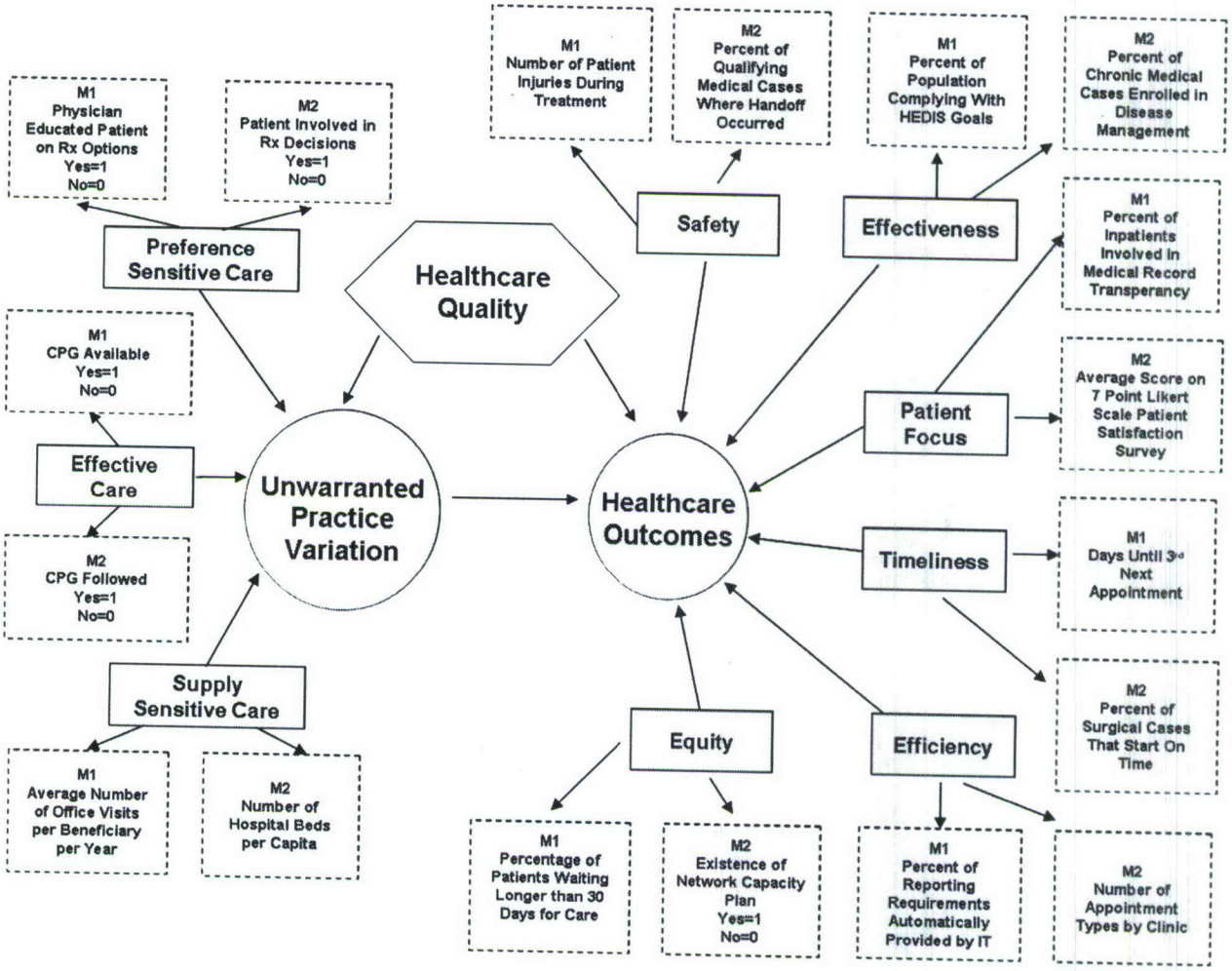

Figure 2. Theory of healthcare quality based on unwarranted practice variation and healthcare outcomes

Definitions

A theory of healthcare quality, operationally defined as the degree to which health services increase the likelihood of desired health outcomes consistent with current professional knowledge, is proposed utilizing two constructs: unwarranted practice variation and healthcare outcomes.

The construct of unwarranted practice variation is operationally defined as deviation from the accepted practice of medicine and is defined by three variables: effective care, preference-sensitive care, and supply-sensitive care. These variables are based upon and developed from Wennberg's research on UPV.

Effective care is operationally defined as medical care that is based on clinical evidence or research and is proven to lead to positive clinical outcomes. Failure to provide effective care when the opportunity avails itself is considered UPV. Effective care has two measures: CPG Available and CPG Followed. CPG Available is operationally defined as a CPG being available during the treatment encounter coded as yes = 1, 0 otherwise. CPG Followed is operationally defined as a CPG being available during the treatment encounter and the medical provider followed the CPG coded as yes = 1, 0 otherwise. Measures coded as 0 indicate UPV.

Preference-sensitive care is operationally defined as care where at least two valid treatment strategies exist, each with its own risks and benefits, and neither option has a clear outcome benefit over the other. Treatment decisions related to PSC should belong to the patient. PSC has two measures: Physician Educated Patient on Rx Options and Patient Involved in Treatment (Rx) Decisions. Physician Educated Patient on Rx Options is operationally defined as documentation in the medical record that the provider explained all treatment options and answered the patient's questions and concerns coded as yes = 1, 0 otherwise. Patient Involved in

Treatment (Rx) Decisions is operationally defined as documentation in the medical record that the patient chose a treatment course of action coded as yes = 1, 0 otherwise. Measures coded as 0 indicate UPV.

Supply-sensitive care is operationally defined as those healthcare services where the frequency of use has not been reliably determined by medical theory, professional consensus, or scientific evidence. SSC has two measures: Average Number of Office Visits per Beneficiary per Year and Number of Hospital Beds per Capita. Average Number of Office Visits per Beneficiary per Year is operationally defined as the sum of all outpatient office visits documented in the past 12 months divided by enrolled beneficiaries and is recorded as a ratio value. Number of Hospital Beds per Capita is operationally defined as the number of hospital beds per given medical treatment facility (MTF) divided by the enrolled population of that MTF and is recorded as a ratio value. SSC measures are evaluated against national benchmarks; values higher than the benchmark indicate UPV.

The construct of healthcare outcomes is operationally defined as the end result of interactions within the AMEDD healthcare system. Healthcare outcomes are defined by six variables: safety, effectiveness, patient focus, timeliness, efficiency, and equity.

Safety is operationally defined as healthcare that avoids injury to patients during its provision. Safety is described by two measures: Number of Patient Injuries During Treatment and Percent of Qualifying Medical Cases Where Handoff Occurred. Number of Patient Injuries During Treatment is operationally defined as the number of documented injuries to patients during the provision of healthcare and is recorded as a ratio value. Percent of Qualifying Medical Cases Where Handoff Occurred is operationally defined as the percentage of cases where a continuity of care handoff should have occurred between healthcare providers actually occurred

and is recorded as a ratio value. Measures of safety are compared against national benchmarks and evaluated as a trend.

Effectiveness is operationally defined as healthcare that is based on scientific knowledge and provided to those who may benefit. Effectiveness is described by two measures: Percent of Population Complying With HEDIS Goals and Percent of Chronic Medical Cases Enrolled in Disease Management. Percent of Population Complying With HEDIS Goals is operationally defined as the percentage of patients that should have received healthcare testing that actually received it and is recorded as a ratio value. Percent of Chronic Medical Cases Enrolled in Disease Management is operationally defined as the percentage of patients with an identified chronic diagnosis that are enrolled in available disease management and is recorded as a ratio value. Measures of effectiveness are compared against national benchmarks and evaluated as a trend.

Patient focus is operationally defined as healthcare that is centered on, respectful of, and guided by patient values. Patient focus is described by two measures: Percent of Inpatients Involved in Medical Record Transparency and Average Score on 7 Point Likert Scale Patient Satisfaction Survey. Percent of Inpatients Involved in Medical Record Transparency is operationally defined as the percentage of inpatients enrolled an MTF's inpatient medical record transparency program and is recorded as a ratio value. Average Score on 7 Point Likert Scale Patient Satisfaction Survey is operationally defined as the sum of all 7-point Likert scale patient satisfaction surveys divided by the number of respondents and is recorded as a ratio value. Measures of patient focus are compared against national benchmarks and evaluated as a trend.

Timeliness is operationally defined as healthcare that reduces harmful or unnecessary delay in treatment. Timeliness is described by two measures: Days Until 3rd Next Appointment

and Percent of Surgical Cases That Start On Time. Days Until 3rd Next Appointment is operationally defined as the number of days until a primary care manager's 3rd next available appointment and is recorded as a ratio value. Percent of Surgical Cases That Start On Time is operationally defined as the number of surgical cases that start on time divided by the total number of surgical cases and is recorded as a ratio value. Measures of timeliness are compared against national benchmarks and evaluated as a trend.

Efficiency is operationally defined as healthcare that avoids misuse of logistic and mental capital. Efficiency is described by two measures: Percent of Reporting Requirements Automatically Provided by Information Technology and Number of Appointment Types by Clinic. Percent of Reporting Requirements Automatically Provided by Information Technology is operationally defined as the percentage of data reports required by higher headquarters that are completed automatically by an information technology solution and is recorded as a ratio value. Number of Appointment Types by Clinic is operationally defined as the number of different appointment types used by a particular clinic and is recorded as a ratio value. Measures of efficiency are compared against national benchmarks and evaluated as a trend.

Equity is operationally defined as healthcare that provides equal quality of care across socioeconomic strata. Equity is described by two measures: Percentage of Patients Waiting Longer than 30 Days for Care and Existence of Network Capacity Plan. Percentage of Patients Waiting Longer than 30 Days for Care is operationally defined as the number of patients who are not seen within 30 days for wellness appointments and not referred to the network and is recorded as a ratio value. Existence of Network Capacity Plan is operationally defined as the existence of a memorandum of agreement between an MTF and the network to defer daily

capacity underlaps to the network coded as yes = 1, 0 otherwise. Measures of equity are either compared against national benchmarks or themselves historically and evaluated as a trend.

Following Bacharach, the constructs in the model are linked by propositions and the measures of variables in the model are linked by hypotheses. An example of a proposition linking the constructs of unwarranted practice variation and healthcare outcomes is shown in Figure 3. Two examples of hypotheses linking the measures of variables are shown in Figure 4. A code sheet operationalizing the constructs, variables, and measures of the model is found in Figures 5 and 6.

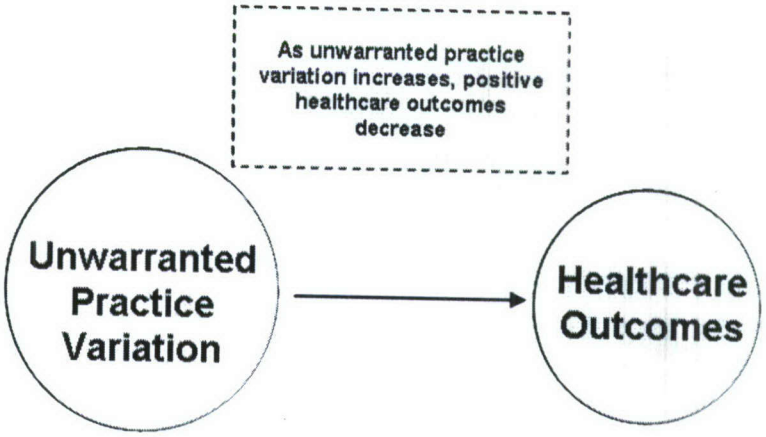

Figure 3. Example proposition for the theory of healthcare variance.

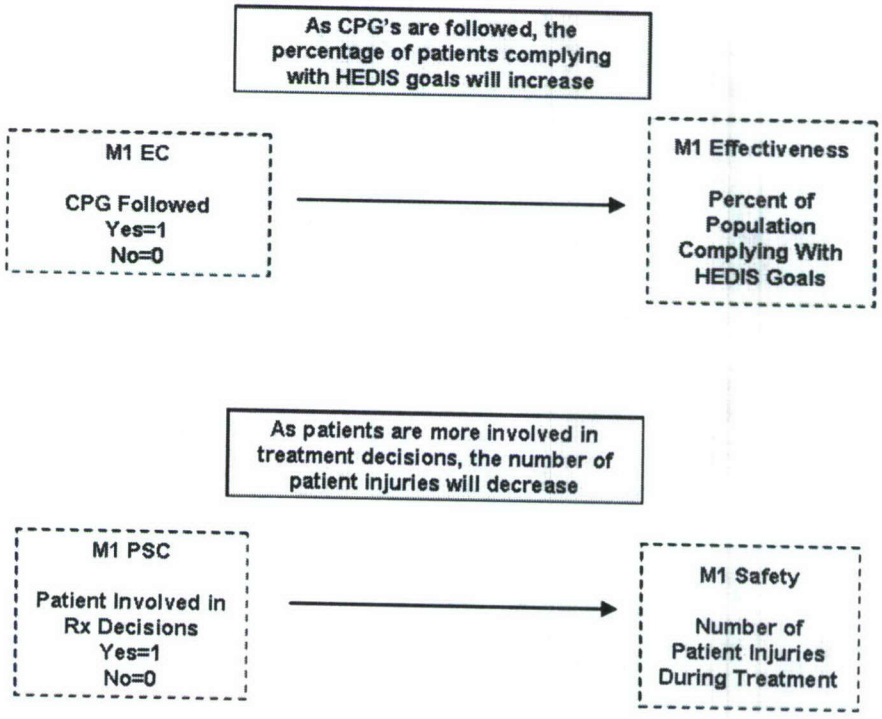

Figure 4. Example hypotheses for the theory of healthcare variance

Constructs	Variables	Measures	Operationalized as:	Coded as:
Unwarranted Practice Variation			Deviation from the accepted practice of medicine	
	Effective Care		Medical care that is based on clinical evidence or research and is proven to lead to positive clinical outcomes	
		CPG Available	Was a CPG available during the treatment encounter?	1 = Yes 0 = No
		CPG Followed	Was a CPG available during the treatment encounter and did the medical provider follow the CPG?	1 = Yes 0 = No
	Preference Sensitive Care		Care where at least two valid treatment strategies exist, each with its own risks and benefits, and neither option has a clear outcome benefit over the other	
		Patient Involved in Rx Decisions	Is there documentation in the medical record that the patient chose a treatment course of action?	1 = Yes 0 = No
		Patient Educated Patient on Rx Options	Is there documentation in the medical record that the provider explained all treatment options and answered the patient's questions and concerns?	1 = Yes 0 = No
	Supply Sensitive Care		Those healthcare services where the frequency of use has not been reliably determined by medical theory, professional consensus, or scientific evidence	
		Average Number of Office Visits per Beneficiary per Year	The sum of all outpatient office visits documented in the past 12 months divided by enrolled	Ratio value
		Number of Hospital Beds per Capita	The number of hospital beds per given MTF divided by the enrolled population of that MTF	Ratio value

Figure 5. Code sheet for unwarranted practice variation in healthcare quality model

Constructs	Variables	Measures	Operationalized as:	Coded as:
Healthcare Outcomes			The end result of interactions with the AMEDD healthcare system	
	Safety		Healthcare that avoids injury to patients during its provision.	
		# of Patient Injuries During Treatment	The number of documented injuries to patients during the provision of healthcare	Ratio value
		% of Qualifying Medical Cases Where Handoff Occurred	The percentage of cases where a continuity of care handoff should have occurred between healthcare providers actually occurred	Ratio value
	Effectiveness		Healthcare that is based on scientific knowledge and provided to those who may benefit	
		% of Population Complying With HEDIS Goals	The percentage of patients that should have received healthcare testing that actually received it	Ratio value
		% of Chronic Medical Cases Enrolled in Disease Management	The percentage of patients with an identified chronic diagnosis that are enrolled in available disease management	Ratio value
	Patient Focus		Healthcare that is centered on, respectful of, and guided by patient values	
		% of Inpatients Involved in Medical Record Transparency	The percentage of inpatients enrolled an MTF's inpatient medical record transparency program	Ratio value
		Average Score on Patient Satisfaction Survey	The sum of all 7-point Likert scale patient satisfaction surveys divided by the number of respondents	Ratio value
	Timeliness		Healthcare that reduces harmful or unnecessary delay in treatment	
		Days Until 3rd Next Appointment	The number of days until a primary care manager's 3rd next available appointment	Ratio value
		% of Surgical Cases That Start On Time	The number of surgical cases that start on time divided by the total number of surgical cases	Ratio value
	Efficiency		Healthcare that avoids misuse of logistic and mental capital	
		% of Reporting Requirements Automatically Provided by IT	The percentage of data reports required by higher headquarters that are completed automatically by an information technology solution	Ratio value
		# of Appointment Types by Clinic	The number of different appointment types used by a particular clinic	Ratio value
	Equity		Healthcare that provides equal quality of care across socioeconomic strata	
		% of Patients Waiting >30 Days for Care	The number of patients who are not seen within 30 days for wellness appointments and not referred to the network	Ratio value
		Existence of Network Capacity Plan	The existence of a memorandum of agreement between an MTF and the network to defer daily capacity underlaps to the network	1 = Yes 0 = No

Figure 6. Code sheet for healthcare outcomes in healthcare quality model

Assumptions

Certain assumptions are made to simplify the model. First, the AMEDD healthcare system is considered closed and unaffected by competitive factors; though the unit of analysis is the AMEDD, the scope of any particular measurement can be limited by region, MTF, product line, or clinic. Second, all measures are accurately quantifiable. Third, appropriate practice variation is only valid under preference-sensitive care; deviations from effective care or benchmarking in SSC are considered UPV. Fourth, measures are assumed to be easily introduced and measured by facilities.

Results and Discussion

General

The model presented herein represents a robust yet simple model of healthcare quality based on the concept of UPV. Most importantly, the research question is addressed through the model and the literature review; specific examples of UPV and outcomes are identified and isolated in the model.

Due to the qualitative nature of the project, the model is difficult to fully evaluate from the perspective of Bacharach's testing criteria. The model does present significant utility as a method to identify correctible UPV, institute healthcare system changes to minimize both its occurrence and impact, and measure post-treatment effects of system changes. The model also provides adequate opportunity to falsify the proposed theory through its empirical measures, operationalized constructs and variables, and logical adequacy.

Quantifiable measures describing the model's variables are relatively limitless. Variables can plausibly assume any form and prove useful as a test of the model; examples include

dichotomous "yes-no" answers to questions regarding utilization of evidence-based medicine, ordinal customer satisfaction data along a Likert scale, and continuous patient data as a means to measure trends. Though the model lends itself to myriad measures for each variable, example measures in the model are limited to two per variable for simplicity's sake.

Limitations

Numerous limitations in the model are readily apparent. Though reflecting current literature on unwarranted practice variation and healthcare outcomes, the model is limited in scope as a predictor of healthcare quality. The model fails to completely investigate other potential constructs such as physician preferences, physician training, and patient behavior and is limited by the paucity of measures for each variable. The model also fails to recognize other encompassing theories of quality such as those of Donabedian (structures and processes) and Kissick (costs and access). Though these shortcomings provide ample material for future research, they hinder the project at hand.

Another significant limitation of the model is the narrow scope of the unit of analysis. The AMEDD encompasses a slim microcosm of the American population: mostly young, healthy patients devoid of the effects of unemployment or lack of health insurance. Broadening the scope of the unit of analysis from the AMEDD to a regional or national focus would allow for a more realistic evaluation of the model and would improve the predictive capacity of any quantitative study that utilized the model.

Qualitative Research Goals

According to Lincoln and Guba (Coppola, 2006), the goals of qualitative research are credibility (confidence in the truth of findings), transferability (applicability to other subjects), dependability (reliability of repeated investigation), and confirmability (objectivity and freedom

from bias). As analogous representations of the quantitative terms validity, reliability, and objectivity, these qualitative research goals have been satisfied primarily through reliance on current literature. Although presenting opportunities for expansion and quantification of the theory presented in this paper as well as theoretical falsification, the limitations of this model present occasion for both Types I and II error and bias when applied in a quantitative setting.

Conclusions and Recommendations

Many challenges face administrators and clinicians relating to practice variation. While we must strive to implement best practices for both our patients and our system, we must not be lulled into a blind algorithm reality. It is of primary importance for both administrators and clinicians to understand when standardization is required and when it is not. In clinical situations where medical evidence and clinical agreement is strong, standardization must be embraced and variation must be minimized; in the opposite situation, flexibility, training, and experience must be respected and variation must be tolerated (IOM, 2001).

As universal acceptance of proven tools such as clinical practice guidelines is still far from reality, effective care initiatives represent an excellent starting point for quantitative studies to test the model presented in this paper. The scope of future studies should be limited in their early stages to provide for ease of implementation, data collection, and rapid reporting of findings. Care should be exercised to assess the model for significant weaknesses and omissions in its design.

The AMEDD should be proud of its long history of clinical, educational, and technological innovation in the field of medicine. Its current efforts centered on the Balanced Scorecard, Joint Commission, HEDIS measures, AHLTA, patient safety initiatives, and support

of the tenets of the IOM are admirable. The AMEDD should also be applauded for the excellent standard of medical care provided to beneficiaries in its MTF's as well as that provided to the warfighter from point of injury to definitive care. No other healthcare organization in the world faces the scope of logistic, budgetary, regulatory, and dynamic constraints inherent to Army medicine.

There is, however, always room for improvement. The following recommendations are made in light of ongoing quality improvement initiatives within the AMEDD.

First, the AMEDD must be, first and foremost, patient-focused. We must place our system, our practices, and our selves in the shoes of the patient and ask the tough question, "What would my patient want?" We must move from a position of making our patients fit our systems and start making our systems fit our patients. Proven initiatives like open access and patient accessible medical records, among others, must be embraced to improve our service to our customers

Second, the AMEDD must use innovation within the scope of the TRICARE system to provide better continuity of and access to care for its patients. I am often asked by patients that I see for the first time, "Are you going to be here for a while?" Patients long for continuity of care with a primary care manager with whom they can form a clinical relationship and build trust. Despite the operational tempo of our current global situation, we must strive to provide that continuity to our beneficiaries. We must tear down barriers to access such as long queues and frustrating phone systems. We must establish networks with the private sector that have an inherent capacity able to respond in hours to our patient's needs rather than days or weeks. Patients should never be told that appointment schedules are not in the computer yet and that

they should call back next week to check again; we must instill a culture that delivers care for them today regardless of their request.

Third, the AMEDD must continue to leverage information technology to promote efficiency and quality in our healthcare system. I see this as our biggest challenge with the largest payoff to the organization. To promote evidence-based practice, decrease medical errors, and improve quality, CPG must be incorporated into AHLTA, measured through metrics, and compared to outcomes prior to incorporation. To free our medical providers to focus on our core business line, patient care, the stability and user interface of AHLTA must be improved. To gather data about our processes and outcomes, information technology solutions must be developed that utilize data already in our systems, minimizing human interface and interpretation, providing information "push" to our key leaders rather than information "pull".

With continued dedication to the ideals spelled out by the IOM and persistent focus on education and innovation, the path ahead for the AMEDD and its beneficiaries should be bright.

References

AMEDD Command Management System (2007). Evidence-based healthcare. Retrieved April 30, 2007, from https://cms.mods.army.mil/cms/secured/stoplights_frameset.aspx?measure=POPH.

American Society for Quality (2006). History of quality. Retrieved December 28, 2006, from http://www.asq.org/learn-about-quality/history-of-quality/overview/overview.html.

Austenfeld, R. B. (2001). W. Edwards Deming: The story of a truly remarkable person. Retrieved April 25, 2007, from http://www.iqfnet.org/IQF/Ff4203.pdf.

Bacharach, S. B. (1989). Organizational theories: Some criteria for evaluation. *Academy of Management Review, 14,* 496-515.

Cinvestav (2006). Four characteristics of local theoretical models. Retrieved June 17, 2006, from http://www.matedu.cinvestav.mx/filloySDA/four_characteristics.htm.

Cooper, D. R., & Schindler, P. S. (2003*). Business research methods* (8th edition). New York: McGraw-Hill.

Coppola, M. N. (2006). Course Pac (electronic version), HCA 5346 – Quantitative Analysis III: Decision Making with Statistics and Research, Army-Baylor Graduate Program in Health and Business Administration (Unpublished).

Cover the Uninsured.org (2006). Facts and figures. Retrieved June 6, 2006, from http://covertheuninsured.org/factsheets/display.php?FactSheetID=101

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Dictionary.com (2006a). Quality. Retrieved December 28, 2006, from http://dictionary.reference.com/browse/quality.

Dictionary.com (2006b). Variation. Retrieved June 1, 2006, from http://dictionary.reference.com/search?q=variation.

Donabedian, A. (1966). Evaluating the quality of medical care. *The Milbank Memorial Fund Quarterly, 44,* 166-203. Retrieved December 28, 2006 from http://www.blackwell-synergy.com/doi/abs/10.1111/j.1468-0009.2005.00397.x.

Farley, D. O., Vernez, G., Nicholas, W., Quiter, E. S., Dydek, G. J., Pieklik, S., & Cretin, S. (2004). *Evaluation of the low back pain practice guideline implementation in the Army Medical Department.* Santa Monica, CA: RAND. Retrieved April 24, 2007, from http://stinet.dtic.mil/stinet/jsp/advanced-tr.jsp.

Frigg, R., & Hartmann, S. (2006). Models in science. Retrieved February 2, 2007, from http://plato.stanford.edu/archives/spr2006/entries/models-science/.

Hankins, S.D. (2004). The open access appointment system: A phased implementation approach at Keller Army Community Hospital. Retrieved April 26, 2007, from http://stinet.dtic.mil/stinet/jsp/advanced-tr.jsp.

HealthGrades (2004). Patient safety in American hospitals. Retrieved April 30, 2007, from http://www.healthgrades.com/media/english/pdf/HG_Patient_Safety_Study_Final.pdf.

Houck, S., Kilo, C., & Scott, J. C. (2003). Group visits 101. *Family Practice Management, May 2003*. Retrieved April 26, 2007, from http://www.aafp.org/fpm/20030500/66grou.html.

Holt, T. N. (2001). Bringing the balanced scorecard to the AMEDD. *U.S. Army Medical Department Journal, April-June 2001,* 4-14. Retrieved April 26, 2007, from http://stinet.dtic.mil/oai/oai?&verb=getRecord&metadataPrefix=html&identifier=ADA390795.

Institute for Healthcare Improvement (2007). Protecting 5 million lives from harm. Retrieved April 26, 2007, from http://www.ihi.org/IHI/Programs/Campaign/Campaign.htm?TabId=1.

Institute of Medicine. (1999). *To err is human: Building a safer health system.* Washington: National Academy Press.

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st century.* Washington: National Academy Press.

James, B. C., & Hammond, M. E. H. (2000). The challenge of variation in medical practice. Retrieved June 4, 2006, from http://arpa.allenpress.com/pdfserv/10.1043%2F0003-9985(2000)124%3C1001:TCOVIM%3E2.0.CO%3B2.

Kibbe, D. C. (1998). Disease management: Who's caring for your patients? *Family Practice Management, October 1998.* Retrieved April 26, 2007, from http://www.aafp.org/fpm/981000fm/disease.html.

Kiley, K. C. (2007). AMEDD adapts to needs of times. *U.S. Medicine, February 2007.* Retrieved April 24, 2007, from http://www.usmedicine.com/column.cfm?columnID=248&issueID=96.

Kissick, W. L. (1994). *Medicine's dilemmas: Infinite need versus finite resources.* New Haven, CT: Yale University Press.

Kussman, M. (2006). Testimony before the Senate Homeland Security Committee Subcommittee on Federal Finance Management, Government Information, and International Security: VA information technology (June 22, 2006). Retrieved April 30, 2007, from http://www.va.gov/OCA/testimony/other/060622MK.asp.

Murray, M. & Tantau, C. (2000). Same day access: Exploding the access paradigm. *Family Practice Management, September 2000*. Retrieved April 26, 2007, from http://www.aafp.org/fpm/20000900/45same.pdf.

National Committee for Quality Assurance (2007). HEDIS and quality measurement. Retrieved April 24, 2007, from http://web.ncqa.org/tabid/59/Default.aspx.

Nichols, W., Farley, D. O., Vaiana, M. E., & Cretin, S. (2001). *Putting practice guidelines to work in the Department of Defense: A guide for action.* Santa Monica, CA: RAND. Retrieved April 24, 2007, from https://www.qmo.amedd.army.mil/general%20documents/rand_document_4_01.pdf.

O'Hare, C. D. & Corlett, J. (2004). The outcomes of open access scheduling. *Family Practice Management, February 2004*. Retrieved April 26, 2007, from http://www.aafp.org/fpm/20040200/35theo.html.

Phillips, W. R. (1998). Variety: The spice of covered lives. Retrieved June 6, 2006, from http://www.aafp.org/fpm/980300fm/editorial.html.

Philpott, T. (2006). With AHLTA, doctors see fewer patients, longer days. *Military.com, April 7, 2006.* Retrieved April 30, 2007, from http://www.military.com/features/0,15240,93457,00.html.

Rice, W. A. (2004). Unwarranted variation in the medical management of injured civilian workers in the U.S. Army Medical Command. Unpublished graduate management project, Army-Baylor Graduate Program in Health and Business Administration, FT Sam Houston, Texas.

Ross, S. E., & Lin, C-T (2003). The effects of promoting patient access to medical records: A review. *Journal of the American Informatics Association, 10,* 129-138. Retrieved April 30, 2007, from http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=150366&blobtype=pdf.

Shi, L., & Singh, D. A. (2004*). Delivering health care in America: A systems approach* (3rd edition). Sudbury, MA: Jones and Bartlett Publishers.

Sipkoff, M. (2003). Nine ways to reduce unwarranted variation. Retrieved June 1, 2006, from http://www.managedcaremag.com/archives/0311/0311.variation.html.

The Dartmouth Atlas of Healthcare (2006). Unwarranted variations and their remedies: Findings from the Dartmouth Atlas of Healthcare. Retrieved June 1, 2006, from http://www.dartmouthatlas.org/atlases/Unwarranted_Variations.pdf.

The Lewin Group (2005). Health information technology leadership panel: Final report. Retrieved April 30, 2007, from http://www.hhs.gov/healthit/HITFinalReport.pdf.

The Joint Commission (2007). Our history. Retrieved April 30, 2007, from http://www.jointcommission.org/AboutUs/joint_commission_history.htm.

The National Coalition on Health Care (2003). Charting the cost of inaction. Retrieved June 5, 2006, from http://www.nchc.org/materials/studies/Cost_of_Inaction_Full_Report.pdf.

The National Coalition on Health Care (2005). Facts on health care costs. Retrieved June 5, 2006, from http://www.nchc.org/facts/2006%20Fact%20Sheets/Cost%20-%202006.pdf.

U.S. Army Center for Military History (2006). Department of the Army Historical Summary, Fiscal Year 1992. Retrieved January 10, 2007, from http://www.army.mil/cmh/books/DAHSUM/1992/ch06.htm#n2.

U.S. Army MEDCOM Quality Management Office Website (2007). Homepage. Retrieved April 26, 2007, from https://www.qmo.amedd.army.mil/home.htm.

U.S. Department of Health and Human Services (2004). Thompson launches "decade of health information technology". Retrieved April 26, 2007, from http://www.hhs.gov/news/press/2004pres/20040721a.html.

U.S. Department of Health and Human Services (2007). Health information technology. Retrieved April 26, 2007, from http://www.hhs.gov/healthit/.

U.S. Department of Veterans Affairs (2006). VA receives 2006 innovations in government award. Retrieved April 30, 2007, from http://www1.va.gov/opa/pressrel/pressrelease.cfm?id=1152.

U.S. Department of Veterans Affairs (2007). VA/DoD clinical practice guidelines. Retrieved April 25, 2007, from http://www.oqp.med.va.gov/cpg/CPG.htm.

U.S. Medicine (2005). DoD promotes AHLTA electronic record. Retrieved April 25, 2007, from http://www.usmedicine.com/article.cfm?articleID=1214&issueID=82.

Wennberg, D. E., & Wennberg, J. E. (2003). Addressing variations: Is there hope for the future? *Health Affairs, W3*, 614-617. Retrieved June 1, 2006 from http://content.healthaffairs.org/cgi/reprint/hlthaff.w3.614v1.pdf.

Wennberg, J. E. (2002). Testimony before the Subcommittee on Health of the House Committee on Ways and Means: Hearing on promoting disease management in Medicare (April 16, 2002). Retrieved June 1, 2006, from http://waysandmeans.house.gov/legacy/health/107cong/4-16-02/4-16wenn.htm.

Whitney, K. R. (2005). Soldier centered care: A revolutionary strategy to move beyond "sick call". *The Uniformed Family Physician, Fall 2005*. Retrieved April 30, 2007, from http://www.usafp.org/Word_PDF_Files/2005-Fall-Newsletter-Bookmarked.pdf.

Wikipedia.com (2006a). Mathematical model. Retrieved June 17, 2006 from http://en.wikipedia.org/wiki/Mathematical_model.

Wikipedia.com (2006b). Model. Retrieved June 17, 2006 from http://en.wikipedia.org/wiki/Model_%28abstract%29.

Wikipedia.com (2006c). Ockham's razor. Retrieved June 17, 2006 from http://en.wikipedia.org/wiki/Occam%27s_Razor.

Wikipedia.com (2006d). Theory. Retrieved June 17, 2006 from http://en.wikipedia.org/wiki/Theory.